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ABSTRACT

This paper provides guidelines for creating REALs (Rich Environments for Active Learning) on the World Wide Web and demonstrates how those guidelines have been applied in a variety of Web-based learning environment contexts. The paper is organized according to the following attributes of student-centered REALs: (1) promote intentional learning by encouraging the growth of student responsibility, initiative, decision making, and intentional learning, including support for transition to an online learning environment, setting goals, metacognitive awareness, and time management; (2) apply dynamic, generative learning activities that promote high level thinking processes (i.e., analysis, synthesis, problem solving, experimentation, creativity, and examination of topics from multiple perspectives) to help students integrate new and old knowledge and, thereby, create rich and complex knowledge structures, including creating and providing access to resources; (3) utilize authentic learning contexts to promote study and investigation, including contextualizing learning, making learning complex, increasing meaningfulness and realism of activities, and encouraging research; (4) encourage collaboration to cultivate an atmosphere supportive of knowledge building communities; and (5) reinforce reflection by embedding opportunities to reflect on the learning process as well as on the content acquired to promote both learning and metacognitive skill development. (MES)

Rich Environments for Active Learning on the Web: Guidelines and Examples

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Abstract: Rich environments for active learning (REALs) are student-centered learning environments that rely on authentic contexts, collaboration, intentional learning, generative learning, and reflection. They are highly interactive, and depend on a great deal of intellectual probing by the instructor/facilitator and collaboration among students to be successful. Can REALs – typically established in a face-to-face classroom setting – be replicated using distance learning technologies, specifically the World Wide Web? This presentation provides guidelines for creating REALs on the Web, and demonstrates how those guidelines have been applied in a variety of Web-based learning environment (WBLE) contexts.

Rich environments for active learning (REALs) are comprehensive instructional systems that engage students in dynamic, authentic learning activities that increase their control and responsibility over the learning process while they learn problem-solving and collaborative skills and content (Dunlap, 1992; Dunlap & Grabinger, 1992, 1993, 1996; Grabinger & Dunlap, 1995; Grabinger, Dunlap, & Duffield, 1997). REALs are based on a constructivist view of learning, which holds that knowledge is acquired through “a process of subjective construction on the part of the experiencing organism rather than a discovering of ontological reality” (von Glasersfeld, 1979, p. 109). This is then, by definition, a student-centered process. It is also a social process of negotiation, conversation, testing, and challenging (Bauersfeld, 1995; Cobb, 1994). In order to be student-centered, REALs have the following attributes:

1. Promote intentional learning by encouraging the growth of student responsibility, initiative, decision making, and intentional learning;
2. Apply dynamic, generative learning activities that promote high level thinking processes (i.e., analysis, synthesis, problem solving, experimentation, creativity, and examination of topics from multiple perspectives) to help students integrate new and old knowledge and thereby create rich and complex knowledge structures;
3. Utilize authentic learning contexts to promote study and investigation;
4. Encourage collaboration to cultivate an atmosphere supportive of knowledge building communities; and
5. Reinforce reflection by embedding opportunities to reflect on the learning process as well as on the content acquired to promote both learning and metacognitive skill development.

The following are guidelines for creating REALs, and examples of how these guidelines can be realized in a Web-based learning environment (WBLE).

1. Promoting Intentional Learning

REALs support intentional learning. Students engaged in intentional learning are purposeful, effortful, self-regulated, and active learners (Palincsar & Klenk, 1992; Scardamalia & Bereiter, 1985; Scardamalia, Bereiter, McLean, Swallow, & Woodruff, 1989; Scardamalia & Bereiter, 1991; Scardamalia & Bereiter, 1997). REALs attempt to give students more executive control over their learning to enable them to take more ownership, find more relevance, and learn lifelong learning skills. Creating autonomous, lifelong learners, REALs teach students to manage their own learning: identify their learning needs, set learning objectives, select and employ learning strategies, identify and use appropriate resources, and assess their overall process. To be intentional learners, students must identify learning deficiencies and strengths, make and implement plans, develop metacognitive awareness, and revise those plans and actions based on that awareness. To teach for intentional learning means to cultivate those general abilities that make it possible to become independent, lifelong learners (Palincsar, 1990).

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Therefore, support for intentional learning begins with fundamental operational behaviors and moves on to learning and metacognitive strategies.

1.1 Support for Transition to an Online Learning Environment

"Students need support and direction to enable them to make the transition from traditional classroom environment to self-directed learning – particularly tools to help them monitor their progress and obtain timely feedback on their activities" (Sherry, 1995, p.352). Hardy and Boaz (1997, p. 1) define student development as the process of preparing "the student for a distance education experience, beyond the technical orientation." This orientation needs to include learning to operate within the online/Web learning environment and refining metacognitive skills. To be successful, students will "need guidance in putting information together, reaching their tutors, and completing and submitting assignments" (Sherry, 1995, p.352).

Regis University does an excellent job of setting the stage for students entering a Web-based learning environment. For each course, students are provided with detailed information regarding getting started in the course; what to expect in the course; how to access course and technical support; what it means to be an online learner and how to be a successful online learner; and how to engage in the course structure, with the course content, and with other students, resources, and the instructor. See: <http://www.cudenver.edu/~jdunlap/webnet99/regisoverview.html>

1.2 Setting Goals

An important part of operating intentionally is the ability to set realistic and appropriate goals. Since an online/Web learning environment relies heavily on independent initiative and study, these goals need to be meaningful to the student. Part of setting goals is the ability of students to identify what they know and what they do not know. Learning contracts (Knowles, 1975) and action plans are useful tools for providing students structure for goal setting while encouraging independence. For an example of a simple Web-based action plan structure, see: <http://www.cudenver.edu/~jdunlap/webnet99/actionplan.html>

Problem-based learning (PBL) is an instructional methodology that engages students in formalized, explicit goal setting activities. Some great examples of PBL in a Web environment exist. See: <http://www.uchsc.edu/chancellor/offedu/pbl/pbl.html> for a Web-based PBL activity on ethical decision-making, and <http://education.indiana.edu/~ist/courses/r590/la/critical.html> for a Web-based PBL activity on Internet rights and responsibilities in a K-12 environment.

1.3 Metacognitive Awareness

Metacognition is an individual's "knowledge about their own cognitive processes and their ability to control these processes by organizing, monitoring, and modifying them as a function of learning outcomes" (Weinstein & Mayer, 1986). Being aware of one's own cognitive processes involves the utilization of metacognitive skills – "the steps that people take to regulate and modify the progress of their cognitive activity: to learn such skills is to acquire procedures that regulate cognitive processes." (Von Wright, 1992, p. 64) Glaser (1984) describes metacognitive skills as: knowing what one knows and does not know, predicting outcomes, planning ahead, efficiently apportioning time and cognitive resources, and monitoring one's efforts to solve a problem or learn. Metacognitive skills include taking conscious control of learning, planning and selecting strategies, monitoring the progress of learning, correcting errors, analyzing the effectiveness of learning strategies, and changing learning behaviors and strategies when necessary (Ridley, Schutz, Glanz, & Weinstein, 1992).

Reflective journals can be an easy way to help students focus on their metacognitive skills. See the following URLs for simple implementations of reflective journals (more on reflection in section 5 below):

<http://transition.alaska.edu/www/SOE/ed626/journals.html>

<http://www.cudenver.edu/~jdunlap/5990/conferencejournal.htm> (student response to reflective journal questions -- <http://clem.msced.edu/~woodleyx/wbi/online.htm>)

1.4 Time Management

Distance learning (DL) students must be more focused, manage their time more efficiently, and they must be able to work independently as well as in a group (Hardy & Boaz, 1997). Attrition rates in DL programs are extremely high, variously reported from 50% to 80%. Failure to manage time appropriately is a major cause of this attrition. Students are accustomed to attending classes at regular times, which provides a major time management structure. Online learning environments often leave time for participation up to the student. While faculty need to create an environment that allows students to manage their time and be flexible, they must also not allow so much flexibility that students become frustrated or procrastinate. One way of helping students manage their time in an online learning environment is by providing them with clearly defined activity requirements mapped to a calendar or an assignment matrix. See the following URLs for examples:

<http://www.cudenver.edu/~jdunlap/webnet99/calendar.html>

<http://www.cudenver.edu/~jdunlap/5990/5990syllabus.html#Calendar>

2. Applying Dynamic, Generative Learning Activities

REALs involve students in dynamic, generative learning activities. Generative learning activities require students – individually and collaboratively – to be responsible for creating, elaborating, and representing domain knowledge in an organized manner (Cognition and Technology Group at Vanderbilt, 1992; Hannafin, 1992; Scardamalia, Bereiter, McLean, Swallow, and Woodruff, 1989; Scardamalia and Bereiter, 1991). In other words, students are engaged in meaningful and important activities as participants rather than observers. Some generative learning activities provide students with a context or situation requiring them to take action (e.g., a problem that needs to be solved or a case that needs to be analyzed). Other types of generative learning activities require students to determine what it is about a particular content area they wish to know, and then take responsibility for answering their own questions through research and synthesis and representing the acquired knowledge in an organized and accessible way. It is through this process of “generating” knowledge, instead of passively receiving information, that help learners develop structure, strategies, and habit for lifelong learning. Dynamic, generative learning activities, therefore, involve students deeply and constantly in the process of creating solutions to authentic problems through the development and completion of projects. These kinds of learning activities require a shift in the traditional roles of students and instructors. Teachers become facilitators and guides, rather than presenters of knowledge. Students become active investigators, seekers, and problem solvers working purposefully on a challenge.

2.1 Create, Create, and Create

“Dynamic” means active and powerful. Dynamic, generative activities require that students create something meaningful and visible. The Web provides many ways of creating materials and sharing them, either with the class or the worldwide community of practice. Web pages, presentations, papers, or programs are within the means of students to create. The learning activities need to have students create important products that recognize their peripheral participation in a community of practice (Lave & Wenger, 1991).

An example of a Web-based dynamic, generative learning environment is the Web-based Performance Support System (WPSS) (Dunlap & Waterman, 1997; Dunlap, 1998a; Dunlap, 1998b; Dunlap, in press). Similar to electronic performance support systems (EPSS), a WPSS uses the Web to provide on-demand access to integrated information, guidance, advice, assistance, training, and tools to enable high-level job performance. In fact, using the Web to create performance support systems is a perfect fit because the Web is actively used by professionals as a forum for the distribution of current and up-to-date references, instruction, and guidance. By creating a structure that supports individualized and collaborative knowledge building by the people who will actually be using the knowledge, the higher-order thinking, problem-solving, and decision-making regarding the selection and utilization of appropriate learning materials and performance support is done by those who can get the most out of the process. Enabling students to utilize an easy-to-use tool to develop their own WPSS accomplishes two goals:

- they learn about the domain while they are locating, evaluating (which requires utilization of resources), and organizing resources to support their learning activities; and
- once the WPSS is completed it can be used to support further learning activities.

In this way, the WPSS not only enables learners to build a learning resource that will provide them with immediate support and guidance, but also helps them develop structure, strategies, and skills for subsequent lifelong learning activities. For examples of WPSSs in action, see <http://www.cudenver.edu/~jdunlap/wpss.html>

2.2 Provide Access to Resources

REALs are resource intensive. Learning activities usually include the need to find new information to support positions, accomplish tasks, and create products. In a WBLE, therefore, students should be engaged in activities that require them to use the Web and Internet to conduct research – including, as part of the process, the evaluation of the Web and Internet resources employed during the research process. Web-based Performance Support Systems (WPSS) require students to conduct research on the Web and evaluate the usefulness of the Web resources utilized. See the WPSS discussion and examples above.

3. Utilizing Authentic Learning Contexts

In REALs, learning requires the use of authentic cognitive, psychomotor, and affective skills. An authentic task, activity, or goal provides learning experiences as realistically as possible, taking into consideration the age and maturation level of the students and environmental constraints such as safety and resource availability. Authenticity is an important part of a REAL for three reasons. First, realistic problems hold more relevance to students' needs and experiences because they can relate what they are learning to problems and goals that they see every day (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991; Pintrich, Marx, & Boyle, 1993). Second, authentic situations that reflect the true nature of problems enable students to develop deeper and richer knowledge structures (Albanese & Mitchell, 1993) leading to a higher likelihood of transfer to novel situations. Finally, authenticity encourages collaboration and negotiation (Johnson & Johnson, 1979; Lowry & Johnson, 1981). Ill-structured, complex problems require a team approach that provides natural opportunities for learners to test and refine their ideas and to help each other understand the content.

3.1 Contextualize Learning

REALs make sure that learning arises from an authentic context. This can be a simulation, case, problem, or task. Contextualized learning is more easily transferred to other situations than decontextualized learning. Regis University uses authentic case studies to drive learning of content and to give focus to student online interaction and collaboration (<http://www.cudenver.edu/~jdunlap/webnet99/regiscase.html>).

3.2 Make Learning Complex

Authentic learning is complex learning. Over simplified learning is neither authentic nor valuable in a contextualized sense. Simplified situations often provide incorrect understandings that get in the way of future learning and refinements (Spiro & Jehng, 1990). Students exposed to a situation in its natural complexity create richer knowledge structures more useful for future application and learning. Additionally, complex learning contexts encourage more meaningful collaboration. Students do not mind collaborating when it is necessary to achieve a goal that one person could not attain on his or her own. The Curry School of Education at the University of Virginia has developed a number of interactive projects that involve students in authentically complex learning activities such as frog dissection, a multimedia teaching case, and instructional design practitioner cases:

The Interactive Frog Dissection: <http://curry.edschool.virginia.edu/go/frog/home.html>

Multimedia Teaching Case: <http://www.people.Virginia.EDU/~tedcases/>

Instructional Design Practitioner Cases: <http://curry.edschool.Virginia.EDU/go/ITcases/Terry/>

3.3 Increase Meaningfulness and Realism of Activities

Meaningful activities are crucial to REALs for three reasons. First, meaningful activities provide motivation for working in an online learning environment -- the reason for logging on and checking the Web discussion forum, for example. Second, meaningful activities help learners develop knowledge structures that will enable them to transfer

their learning to new situations. Meaningfulness provides context that prevents the formation of inert knowledge (Whitehead, 1929). Finally, meaningful activities are seen by students as more realistic -- they are meaningful because they relate somehow to the students' "real world" situation.

The WWW -- through the use and integration of multimedia, video, audio, databases, hypermedia, networks, and e-mail -- allow us to create micro- and virtual worlds that can engage students in meaningful activities that reflect the real world (Collins & Brown, 1986). Examples provided by the Curry School of Education demonstrate how the use of multimedia can enhance the realism of the learning activities being presented (see URLs above). A good Web site for finding virtual tours that can be used for classroom applications is Virtual Tours at <http://www.dreamscape.com/frankvad/tours.html>. This site lists dozens of museums, exhibits, real time tours, and virtual cameras from around the world. The American Museum of Natural History <http://www.amnh.org/> is a rich source of exhibits covering topics from the sciences, social studies, and more. They sponsor online expeditions and Webcasts with scientists and researchers. Other examples of virtual learning activities include:

The Virtual Electron Microscope: <http://www.uq.edu.au/nanoworld/online.html>

Virtual Tourist: <http://www.vtourist.com/>

3.4 Encourage Research

REALs require some kind of research activity. One of the major strengths of online learning environments is their access to people, resources, and databases of information. Research, and especially the search process, should be important components of online learning activities. In an online environment, students can more easily come into proximity with communities of practice because the Internet serves as a gateway to a world community of learners and practitioners. Browsers and search engines are vehicles for exploration providing students with critical skills of goal setting, self-directed learning, and testing hypotheses. There are a number of Web-based examples of engaging students in projects that encourage research. See the URLs below for contextualized examples of projects that have research as an important component of meeting the requirements of the larger challenge.

Hosting a Virtual Conference Activity:

<http://www.cudenver.edu/~jdunlap/5990/conference.html> (See, also, examples of the virtual conferences designed at <http://carbon.cudenver.edu/~jdunlap/seminar/> and <http://web-education.net/fall98conf/>)

Web Site/Unit Evaluation Activity for K-12 Teachers:

<http://www.cudenver.edu/~jdunlap/webnet99/siteeval.html>

4. Encouraging Collaboration

REALs demand collaboration among students to achieve complex goals. Collaboration acknowledges the social nature of knowledge construction (Bauersfeld, 1995; Cobb, Yackel, & Wood, 1992; Roth, 1990). Through collaborative work, students experience and develop an appreciation for multiple perspectives; they refine their knowledge through argumentation, structured controversy, and the sharing and testing of ideas and perspectives; they gain an appreciation for the value of cooperation and the individual strengths that members of the team bring to the group; and, they are more willing to take on the risk required to tackle complex, ill-structured, authentic problems when they have the support of others in the cooperative group. Therefore, with the support of others in the group, students are more likely to achieve goals they may not have been able to meet on their own. Collaboration also facilitates generative learning.

Web forums and threaded discussions are easy ways to establish an environment for group discussion and collaboration. However, in order to make sure that students are motivated to participate in online discussion and collaboration, it is advisable to have a problem, challenge, case, or project drive and provide a focus for student participation in an online environment. For an example, see: <http://www.cudenver.edu/~jdunlap/mess.cgi>

More elaborate examples of collaborative learning environments on the Web also exist. A great example is the Learning Through Collaborative Visualization Project (CoVis). CoVis is an online community of thousands of students, over one hundred teachers, and dozens of researchers all working together to find new ways to think about and practice science in the classroom. See: <http://www.covis.nwu.edu/>

5. Reinforcing Reflection

Self-reflection activities need to be embedded into REALs in order to support the development of metacognitive skills. "Self-reflection implies observing and putting an interpretation on one's own actions, for instance, considering one's own intentions and motives as objects of thought" (Von Wright, 1992, p. 61). Von Wright describes the process of self-reflection as the ability to think about one's self as an intentional subject of personal actions and to consider the consequences and efficacy of those actions. This involves the ability to look at one's self in an objective way and to consider ways of changing to improve performance. Dewey (1933) described the value of reflection as a component of educated thinking. Even though reflective activity is important, it is possible for students to be so caught up in completing a task that they fail to reflect, hindering what they learn. "We can keep students so busy that they rarely have time to think about what they are doing, and they may fail to become aware of their methods and options" (Wheatley, 1992, p. 536). Schön (1983) refers to this as being "in the action" rather than reflecting on the action. If students do not have opportunities to examine their methods and options, they will not develop the metacognitive skills needed for lifelong learning. Therefore, learning activities need to support students in reflecting on their own learning and problem-solving processes, as well as on what they have learned (Schön, 1987).

Engaging students in reflection on the content learned and the learning process itself can be done simply by having a set of questions that students answer throughout a learning activity and once the learning activity is completed. Possible reflective questions that address the content and skills learned include:

- How did your prior knowledge affect your approach to the project? Be specific in describing your prior knowledge and how it affected your approach.
- What are three of the most important things that you learned about your topic while working on this project? Why do you consider them important? Be specific.
- Do you believe that your learning from this project represents the breadth of the topic? Why?
- Do you believe that what you were able to learn something about this topic in depth? If so, what is that?
- What did you learn that you could apply to other problems or projects? How?
- What topics did you encounter that you would like to study more? How will you do that learning?

Possible reflective questions that address the learning process include:

- What did you learn about your ability to learn? What new learning/metacognitive skills did you acquire? What did you learn that will make you a more efficient and effective learner on future assignments?
- What kinds of learning problems did you encounter while working on the topic? How did you overcome them? Did anyone else offer useful assistance (who and how)?
- How can you improve as a learner? What are your weaknesses? How will you strengthen them? What will you do differently the next time?
- How has the communication environment affected your learning?
- What could make communicating with the instructor or other students more meaningful?
- What resources did you identify that you will use again? Why?
- When you had trouble finding the information that you needed, what did you do?

Reflective journals can be implemented online very easily using email or Web forms -- see:

<http://transition.alaska.edu/www/SOE/ed626/journals.html>

<http://www.cudenver.edu/~jdunlap/5990/conferencejournal.htm>

Conclusion

REALs are one way of conceptualizing and applying the attributes of a rich, active learning environment. It helps to break those attributes down into guidelines when determining how to create these types of learning environments for face-to-face or Web-based settings. This paper only presents a few examples of the many excellent implementations of REAL guidelines to Web-based and other online learning environments. Because of the power of the Web -- to provide information in a just-in-time manner, establish immediate access to people and resources, utilize multimedia and hypermedia technologies, provide a forum for communication and collaboration, etc. -- it is fairly easy to realize the promise of REALs in an online learning environment.

Note: For references and more examples of REALs on the Web: <http://www.cudenver.edu/~jdunlap/webnet99/references.html>